

1 Q. The response to PR-PUB-NLH-010 states that Unit 1 at the Holyrood Plant meets
2 ISO-7919-2 guidelines for unrestricted, long-term operation. Please provide the
3 2014 vibration measurements that are within Zone B of the guideline that justify
4 unrestricted, long-term operations.

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7 A. With respect to the 2014/2015 winter operating season, Hydro conducted a specific
8 series of vibration testing during the period December 7 to 10, 2014 at various
9 levels on Unit 1. Please refer to for the table below for Unit 1 vibration
10 measurements observed. Please see PR-PUB-NLH-123 Attachment 1 for the
11 guidelines Hydro's service provider, Alstom, used in their assessment of the unit.

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Unit 1 Vibration Data

	December 7, 2014 (70 MW)		December 7, 2014 (100 MW)		December 10, 2014 (130 MW)		December 8, 2014 (150 MW)	
Bearing	Vertical (µm)	Horizontal (µm)	Vertical (µm)	Horizontal (µm)	Vertical (µm)	Horizontal (µm)	Vertical (µm)	Horizontal (µm)
1	92	118	100	133	102	133	80	110
2	52	64	62	81	65	80	57	63
3	81	90	86	89	79	82	66	76
4	37	48	45	54	39	55	44	52
5	34	72	28	69	26	69	28	67

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Evaluation of Turbo-Set Vibration

TABLE 3.1: Vibration Limits for Generators and Steam Turbines at Rated Speed

Measurement	Bearing Vibration	Relative Shaft Vibration		
Applied Standard	ISO 10816-2	ISO 7919-2		ISO 7919-3
Units	Velocity mm/s, rms,(ips, rms) (1 ips = 25.4 mm/s)	Displacement p-p µm, p-p, (mils, p-p) (1 mil = 25.4 µm)		
Power	P > 50 MW	P > 50 MW		P < 50 MW
Nominal Speed	3000 and 3600 rpm	3000 rpm	3600 rpm	Speed > 3600, n = rpm
Zone Boundary A/B	3.8 (0.15 ips)	80 (3.1 mils)	75 (2.9 mils)	4800/√n
Zone Boundary B/C	7.5	165	150	9000/√n
Alarm Limit	(0.29 ips)	((6.5 mils)	(5.9 mils)	
Zone Boundary C/D	11.8	260	240	13200/√n
Trip Limit	(0.46s)	(10.2 mils)	(9.4 mils)	

TABLE 3.2: Vibration Limits for Generators and Steam Turbines at Rated Speed

Measurement	Absolute Shaft Vibration	
Applied Standard	ISO 7919-2	
Units	Displacement p-p μm, p-p, (mils, p-p) (1 mil = 25.4 μm)	
Power	P > 50 MW	
Nominal Speed	3000 rpm	3600 rpm
Zone Boundary A/B	100 (3.9)	90 (3.5)
Zone Boundary B/C	200	180
Alarm Limit	(7.9)	(7.1)
Zone Boundary C/D	320	290
Trip Limit	(12.6)	(11.4)

Zone A: The vibration of newly commissioned machines falls within this zone.

Zone B: Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.

Zone C: Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally the machine may be operated for a limited period in this condition until a suitable opportunity arises for remedial action.

Zone D: Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.